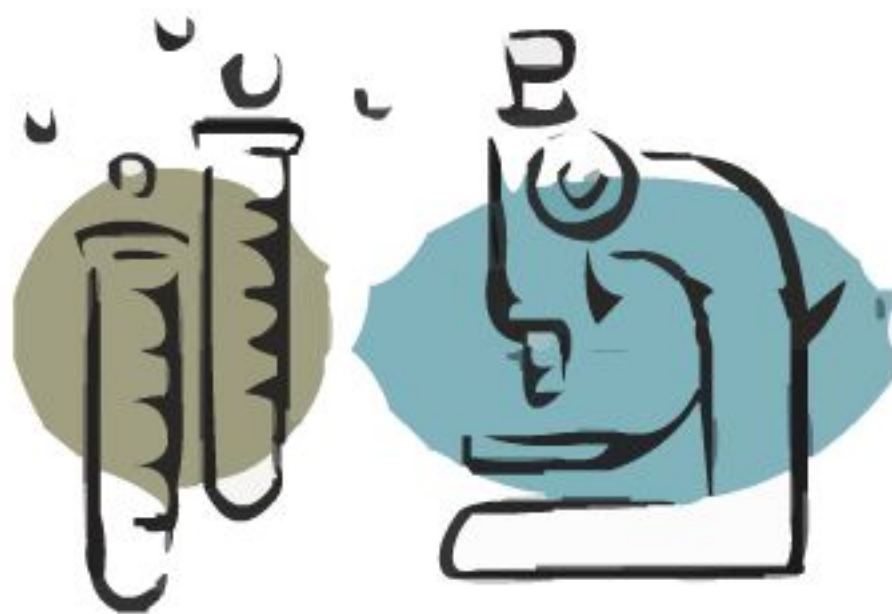


# Summary of



## These notes contain:

- \* Schemes for:
  - CBC report, urine report and liver profile report
- \* Tables of differential diagnosis for:
  - Urine report, cardiac enzymes, CSF report, glucose tolerance curves and hepatitis markers
- \* Diagrams for cardiac enzymes, glucose tolerance curves and Hepatitis Markers

# Clinical Pathology

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More Than You Dream

Special Thanks to  
Dr Ashraf Zaki

## CBC Report

Table Parameters of CBC Report							
RBCs							
Parameters	Normal	Abnormal		Significance			
RBCs count	5 million /cmm	If the 3 parameters are increased If the 3 parameters are decreased		Polycythemia Anemia			
Hemoglobin	15 gm %						
Hematocrite (PCV)	45 %						
Mean Corpuscular Diameter ( MCD)	6-8 Micrometer	If the 2 parameter are increased		Macrocytic			
Mean Corpuscular Volume (MCV)	76-96 (90) fl	If the 2 parameter are normal		Normocytic			
		If the 2 parameter are decreased		Microchromic			
Mean Corpuscular Hemoglobin (MCH)	27-32 (30) pictogram	If the 2 parameter are increased		Hyperchromic			
Mean Corpuscular Hemoglobin concentration (MCHC)	34 gm %	If the 2 parameter are normal		Normochromic			
		If the 2 parameter are decreased		Hypochromic			
Reticulocytes	0.5-2 %	Reticulocytosis					
		1.Hemolysis		2.Hemorrhage		3.Anemia under treatment	
						4.Recovery from bone marrow depression	
WBCs – Total Leucocytic Count (TLC)				Platelet			
Parameters	Normal	Abnormal	Significance	Parameters	Normal	Abnormal	Significance
TLC	4,000-11,000/cmm			Platelet count	150,000-450,000/cmm	If > 450,000/cmm If < 150,000/cmm	Thrombocytosis Thrombocytopenia
Neutrophils	60-70 %	If > 70 %	Neutrophilia	Staff:segmented	1:5-10	If 1:<5	Shift to left
		If < 60 %	Neutropenia			If 1:>10	Shift to right
Esinophils	3-5 %	If > 5 %	Esinophilia	Basophils	0-1 %	If > 1 %	Basophilia
		If < 3 %	Esinopenia				
Lymphocytes	20-30 %	If > 30 %	Lymphocytosis	Monocytes	3-8 %	If > 8 %	Monocytosis
		If > 20 %	Lymphocytopenia			If < 3 %	Monocytopenia

Table Scheme for CBC Report										
RBCS										
Step I		Look at RBCs count, Hemoglobin concentration, Hematocrite								
Normal		5 million /cmm,		15 gm %,		45 %				
If		The 3 parameters are ↑		The 3 parameters are ↓						
So		Polycythemia		Anemia						
Step II		Look at TLC, Platelet count				Look at MCV, MCD,		MCH,	MCHC	
Normal		4,000-11,000 / cmm, 150,000-450,000 / cmm				90 fl, 6-8 Micrometer,		30 pg,	34 gm %	
If		↑ TLC	Normal TLC	If all ↑↑		If all normal			If all ↓↓	
So		↑ platelet	Normal platelet							
So		Primary polycythemia	Secondary polycythemia	Macrocytic normochromic anemia	Normocytic normochromic anemia			Microcytic Hypochromic anemia		
Step III		Look at TLC, platelet, staff:segmented						Look at esinophils		
If		↓ TLC, ↓ platelet, shift to right		All normal or ↑↑ Shift to left		All ↓↓		If > 5 %	If 3-5 %	
So		Macrocytic anemia		Hemolysis or acute hemorrhage		Aplastic anemia		Ankylostoma infestation	Iron deficiency anemia	
Further investigations		Serum vit B12 Serum folic acid		Confirm by reticulocytic count			Serum iron Serum ferritin Total iron binding capacity			
					↑↑					
					Look at coagulation time					
					If > 8 min, so hemorrhagic					
WBCs										
Step I		Look at TLC								
Normal		4,000-11,000 / cmm								
If		> 50,000 /cmm		11,000-50,000 / cmm			< 4,000 / cmm			
So		Leukemia		Leucocytosis			Leucopenia			
Step II		Look at blast cells		Look at differential count			Neutrophils		Lymphocytes	
Normal							60-70 %		20-30 %	
If		Predominant		Not Predominant		Neutrophils > 70 %		Lymphocytes > 30 %	Neutrophils < 60 % Lymphocytes < 20 %	
So		Acute leukemia		Chronic leukemia		Neutrophilia with relative lymphocytopenia		Lymphocytosis with relative neutropenia	Neutropenia with relative lymphocytosis Lymphocytopenia with relative neutrophilia	
Step III		Determine whether myeloblasts or lymphoblasts are predominant Look at peroxidase stain		Determine whether myelocytes or lymphocytes are predominant		For leucocytosis & leucopenia, determine staff:segmented, so shift				
If		Predominant myeloblasts +ve peroxidase	Predominant lymphoblasts -ve peroxidase	Predominant myelocytes	Predominant lymphocytes	1:>10		1:<5		
So		Acute myeloblastic leukemia	Acute lymphoblastic leukemia	Chronic myeloid leukemia	Chronic lymphocytic leukemia	Shift to right		Shift to left		
Step IV		For leucopenia,look at RBC, platelet								
If		Normal								
So		Leucopenia                      pancytopenia								
Platelets										
Step I		Look at platelets count								
Normal		150,000-450,000 /cmm								
If		> 450,000 /cmm		< 150,000 /cmm						
So		Thrombocytosis		Thrombocytopenia						
Step II		Look at bleeding time (normal: 2-4 min)								
If		> 4 min, so 2 possibilities								
So		1. ↑ bleeding time is result of thrombocytopenia due to aplastic anemia				2. ↑ bleeding time due to purpura				

## Urine report

Table	Items to comment on in a urine report										
1. Volume of urine	Normal	1000-15000 cc/24 h									
Abnormalities	>1500 cc/24 h, Polyuria										
	Causes	Diabetes mellitus	Diabetes insipidis	Chronic renal failure	Functional poluria						
	Specific gravity	High, > 1025	Very low, 1002	1010, fixed	Low						
	others	Sugar	Huge volume	Granular casts	Normal						
	< 800 cc/24 h, Oliguria										
	Causes	Nephritic syndrome		Acute renal failure	Functional oliguria						
	Specific gravity	High		1010, fixed	High						
	others	RBCs & red casts		Granular casts	Normal						
2. Specific gravity	Normal	1015-1025									
Abnormalities	1. High	Diabetes Mellitus Nephritic syndrome			Functional oliguria						
	2. 1010, fixed				Chronic & acute renal failure						
	3. Low	Diabetes insipidis			Functional polyuria						
3. Color & aspect	Amber yellow	Watery	Brownish	Turbid	Smoky	Red	Milky				
	Normal	Polyuria	Jaundice	Infection	Nephritic syndrome, nephritic syndrome		Hematuria	Chylurea			
4. Reaction of urine		5. Albumin (protein)		6. Sugar		7. Ketone bodies (acetone)					
Normal	Acidic 5.5-6.5	Nil		Nil		Nil					
Abnormal	Alkaline urine: indicates infection & explain phosphate crystals	+, ++: Most of kidney disease +++, ++++: Nephrotic syndrome		+, ++, +++, +++++: diabetes mellitus or renal glucosuria		+, ++, +++: ketonurea in diabetes mellitus					
8. RBCs		9. Pus cells		10. Bile pigment		11. Crystals		12. Casts			
Normal	0-4 / HPF	0-4 / HPF		Traces		Nil		Nil or hyaline		Normal	
Abnormal	> 4 / HPF, hematuria	4 / HPF		Increased jaundice		Oxalate & urate      Phosphate		Red		Nephritic syndrome	
Significance	Prerenal: purpura, coagulation defects Renal: nephritic, cancer Postrenal: stone, oxaluria, cancer		Pyelonephritis: with white casts UTI: without white casts		In obstructive, hepatocellular		In acidic urine      In alkaline urine		White		Pyelonephritis
							Crystals may be the cause of hematuria		Fatty		Nephrotic syndrome

Table	Differential diagnosis for urine report											
	Nephritic	Nephrotic	CRF	ARF	Diabetes mellitus	Diabetes insipidus	Functional polyurea	Functional oligurea	Obstructive jaundice	UTI	Pyelonephritis	Post-renal hematuria
<b>Volume</b>	Oligurea		Polyurea	Oliguria	Polyurea	Polyurea (huge)	Polyurea	Oligurea				
<b>Sp. Gr.</b>	High		1010, fixed	1010, fixed	High	Very low, 1002	Low	High				
<b>Aspect</b>	Smoky	Smoky	Watery			Watery	Watery		Brownish	Turbid	Turbid	Red
<b>Protein</b>	+/++	+++ / ++++	+/++	+/++						+/++	+/++	+/++
<b>Sugar</b>					+/++ / +++ / ++++							
<b>Ketone</b>					May be present							
<b>Cells</b>	RBCs > 4/HPF	Epithelial	Epithelial	Epithelial						Epithelial Pus cells > 4/HPF	Epithelial Pus cells > 4/HPF	RBCs > 4/HPF
<b>Casts</b>	Red casts	Fatty casts	Granular casts	Granular casts						NO white casts	White casts	
<b>Bilirubin &amp; bile pigment</b>									Present			
<b>NBs</b>	ARF may occur on top of nephritic				If associated with high protein, so diabetic nephrosis					ARF may occur on top of nephritic		Crystals

## Cardiac enzymes and proteins

Table	Scheme for cardiac enzymes							
<b>Troponin</b>	↑	↑	↑	↑	↑	↑	↑	↑
<b>CK-MB</b>		↑	↑	↑	↑	↑	↑	↑
<b>AST</b>			↑	↑	↑	↑	↑	↑
<b>LDH</b>				↑	↑	↑	↑	↑

## Blood glucose

Table	Blood glucose		
	Normal	Impaired glucose tolerance	Diabetes mellitus
<b>Fasting blood sugar</b>	< 126 mg/dl	126-140 mg/dl	> 140 mg/dl
<b>2 hour Post-prandial blood sugar</b>	< 140 mg/dl	140-200 mg/dl	> 200 mg/dl

## CSF Reports

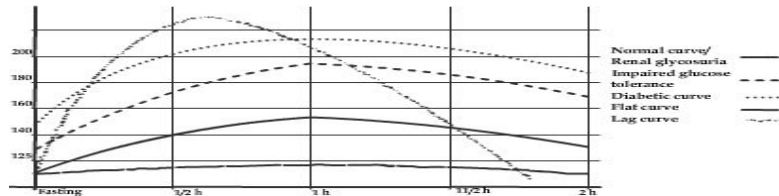
Table	Differential diagnosis for CSF reports					
	Normal					
<b>Protein</b>	20-40 mg %	↑	↑	↑	↑	↑
<b>Sugar</b>	40-80 mg %	↓↓↓	↓	Normal	Normal	↑
<b>Pressure</b>	80-120 mm %	↑	↑	↑	↓	↑
<b>Color</b>	Watery	Very turbid	Slight turbid	Colorless	Yellowish	Red
<b>Cells</b>	RBCs 0-4/HPF WBCs 0-4/HPF	Neutrophils	Lymphocytes	Lymphocytes	Normal (cytoalbuminous dissociation)	↑
<b>Chloride</b>	115-130 mmol/L	↓	↓↓↓	Normal	Normal	
<b>Diagnosis</b>	Normal	Septic meningitis	Tuberculous meningitis	Viral meningitis	Subarachnoid block	Hemorrhage

## 'Summary' Series

- Summary of Special Surgery
- Summary of ECG
- Summary of Diagnostic X-Ray in Medicine

## Glucose tolerance curve

Glucose Tolerance Curve						
Table	Normal	Renal glycosuria	Impaired glucose tolerance	Diabetic curve	Flat curve	Lag curve
<b>Fasting</b>						
	< 126 mg/dl	< 126 mg/dl	126-140 mg/dl	> 140 mg/dl		< 126 mg/dl
<b>Peak</b>	< 160 mg/dl	< 160 mg/dl		> 200 mg/dl	< 126 mg/dl	> 200 mg/dl
<b>2h PP</b>	< 140 mg/dl	< 140 mg/dl	140-200 mg/dl	> 200 mg/dl		< 140 mg/dl
<b>Sugar</b>	Nil	+	Nil	+, ++, +++, ++++	Nil	Nil
<b>Significance</b>	Normal test	Decreased renal threshold for glucose	Impaired glucose tolerance	Diabetes mellitus	Malabsorption Myxedema, addison's, hypopituitarism	Gastrectomy, gastroenterostomy Hyperthyroidism Chronic liver disease



## Liver profile reports

Parameters of liver profile				
Liver profile			Serum enzymes	
Parameters	Normal	Abnormal	Parameters	Normal
Total proteins	6-8 gm%		Serum AST	Up to 32 U/L
Albumin	4-5 gm %	↓	Serum ALT	Up to 31 U/L
Globulin	2-3 gm %	↑	Alkaline phosphatase	80-240 U/L
A/G ratio	2:1	Reversed		↑↑↑
Significance		Chronic liver disease		
Parameters	Normal	Abnormal	Parameter	Normal
Total bilirubin	0.1-1.0 mg %	↑	Prothrombin concentration	100%
Direct bilirubin	15% of total	>15 %	Alfa fetoprotein	Normal
Indirect bilirubin	85 % of total	>85 %		0-10 ng/dl
Significance		Cholestasis		10-400 ng/dl
		Hemolysis		>400 ng/dl
		Liver failure		

Table				Scheme for Liver Profile Reports			
Step I				Look at total bilirubin			
If		Normal		Increased			
So		Proceed to step III		Proceed to step II			
Step II		Look at direct bilirubin & calculate indirect bilirubin					
If		Both direct & indirect elevated		Mainly indirect elevated		Mainly direct elevated	
+ findings				All other findings are normal		Very HIGH alkaline phosphatase ↓ prothrombin	
So		Proceed to step III		Hemolysis or Familial non hemolytic hyperbilirubinemia		Cholestasis	
Step III		Look at AST, ALT, alkaline phosphatase, prothrombin				It is recommended to use this ‘Summary of Clinical Pathology’, after studying your notes	
If		AST ↑↑		—			
		ALT —		↑↑			
		Alk. Phase ↑		↑↑↑			
		Prthrmn ↓		—			
So		Chronic hepatitis		Acute hepatitis			
Step IV		Look at albumin					
If		↓ Normal					
So		With decompensated cirrhosis —					
				Edited & Designed by Mohamed El Far Revised by KH Ibn El-Waleed			

## Hepatitis markers

Markers for HAV, HCV, HDV, HEV, HBV			
	PCR	Antibodies	
<b>Hepatitis A markers</b>	—	HAV IgM	HAV IgG
Significance		Recent infection	Old infection
<b>Hepatitis C markers</b>	HCV RNA	HCV Ab	
Significance		Post exposure to HCV with 85 % carrier	
<b>Hepatitis D markers</b>	HDV RNA	HDV IgM	HDV IgG
Significance		Recent infection	Old infection
<b>Hepatitis E markers</b>	—	HEV IgM	HEV IgG
Significance		Recent infection	Old infection
<b>Hepatitis B markers</b>	HBV DNA	Look after	

Differential diagnosis for HBV markers					
HBsAg	Positive	Negative	Negative	Positive	Negative
HBsAb	Negative	Negative	Positive	Positive	Positive
HBcAb IgM	Positive	Positive	Positive or Negative	Negative	Negative
HBcAb IgG	Positive or Negative	Positive	Positive	Negative	Negative
<b>Acute HBV infection</b>	<b>Window phase of HBV infection</b>				
<b>HBsAg</b>	+ve indicates high infectivity				
HBsAg	—	—	—	—	—
HBsAb	—	—	—	—	—
HBcIgM	—	—	—	—	—
HBcIgG	—	—	—	—	—
Acute Hepatitis B      Window      Chronic Hepatitis B					

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